DERWENT-ACC-NO: 2002-274235

DERWENT-WEEK: 200634

TITLE: A lead free tin-copper-nickel system solder composition
and electric parts soldered using it

PATENT-ASSIGNEE: MURATA MFG CO LTD[MURA]

PRIORITY-DATA: 2000JP-0150427 (May 22, 2000)

PATENT-FAMILY:

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JP 3775172 B2	May 17, 2006	N/A	008	B23K 035/26
JP **2001334384** A	December 4, 2001	N/A	006	B23K 035/26

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
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RELATED-ACC-NO: 2006-003136, 2006-140305

ABSTRACTED-PUB-NO: JP2001334384A

BASIC-ABSTRACT:

NOVELTY - A lead free tin-copper-nickel system solder composition containing
(as weight %) of not less than 0.01 and not greater than 0.5 of Ni, greater
than 2.0 and not greater than 5.0 of Cu, and residual % of Sn.

USE - Used as lead free solder.

ADVANTAGE - Owing to the presence of optimum amount of Ni, the solder composition, whose corrosion of electric conductive metal (Cu) has been reduced
to the level of that of conventional Sn-Pb system solder, can be obtained.

DESCRIPTION OF DRAWING(S) - The diagram shows the key map of the electronic
part soldered using this solder.

The part; 1

the ceramic element; 2

electrodes; 3

ends of copper wire: 4a, 4b

solder. 5

CHOSEN-DRAWING: Dwg.1/2

TITLE-TERMS: LEAD FREE TIN COPPER NICKEL SYSTEM SOLDER COMPOSITION ELECTRIC
PART SOLDER

DERWENT-CLASS: M23 P55 V02 V04 X12 X24

CPI-CODES: M23-A01;

EPI-CODES: V02-D; V04-R04A5; X12-C; X12-C01B; X24-A01A;

SECONDARY-ACC-NO:
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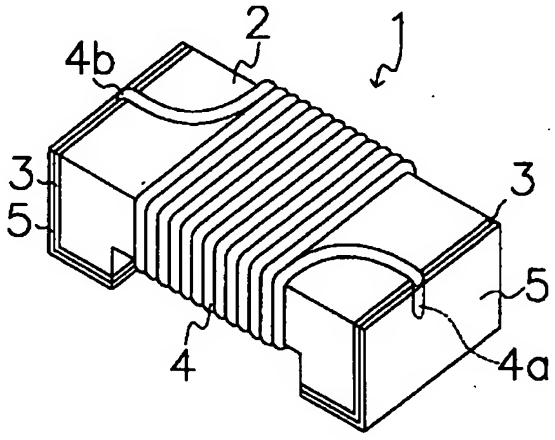
(54)【発明の名称】　はんだ組成物およびはんだ付け物品

(57)【要約】
【課題】本発明の目的は、Ｃｕを主成分とする導体の溶食に関して従来のＳｎ－Ｐｂ系はんだ組成物に近い特性を有する、Ｓｎ基のいわゆるＰｂフリーはんだ組成物を提供することを目的とする。
【解決手段】本発明のはんだ組成物は、Ｎｉ０．０１重量%以上０．５重量%以下と、Ｃｕ２重量%を超えて５重量%以下と、残部Ｓｎとからなり、Ｐｂを含有しないことを特徴とする。本名発明のはんだ付け物品は、Ｃｕを主成分とする導体と、導体に電気的かつ機械的に接合するように取り付けられた本発明のはんだ組成物と、からなることを特徴とする。



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【特許請求の範囲】

【請求項1】　Ni0．01重量%以上0．5重量%以下と、Cu2重量%を超えて5重量%以下と、残部Snとからなり、Pbを含有しないことを特徴とする、はんだ組成物。

【請求項2】　さらにAg，In，Zn，Sb，GeおよびPからなる群より選ばれる少なくとも1種を含有してなることを特徴とする、請求項1に記載のはんだ組成物。

【請求項3】　Ag0．01～3．5重量%，Sb0．01～5重量%，Zn0．01～9重量%，In0．01～10重量%，Bi0．01～3重量%，Ge0．01～0．5重量%およびP0．01～0．5重量%からなる群より選ばれる少なくとも1種と、Ni0．01重量%以上0．5重量%以下と、Cu2重量%を超えて5重量%以下と、残部Snとからなること特徴とする、はんだ組成物。

【請求項4】　Cuを主成分とする導体と、前記導体に電気的かつ機械的に接合するように取り付けられた請求項1～3の何れかに記載のはんだ組成物と、からなることを特徴とする、はんだ付け物品。

【請求項5】　磁性体として機能する材料を含むセラミック素体と、

前記セラミック素体上に設けられた一対の端子電極と、

前記セラミック素体に巻き付けられたCuを芯材とする導体と、

前記導体の一方端部が前記端子電極の一方に、電気的かつ機械的に接合するように取り付けられた請求項1～3の何れかに記載のはんだ組成物と、からなることを特徴とする、はんだ付け物品。

【発明の詳細な説明】

【発明の属する技術分野】本発明は、Pbを含有しないはんだ組成物ならびにはんだ付け物品に関するものであり、特に絶縁樹脂で被覆された金属線の被覆剥離とはんだ付けを同時に実施する場合に好適なはんだ組成物、ならびにはんだ付け物品に関する。

【従来の技術】従来、コイル部品等の製造工程において、巻き線コイルを形成する導体が絶縁樹脂によって被覆されているため、この絶縁樹脂で被覆された金属線の被覆剥離とはんだ付けを同時に実施している。この場合、従来のPb含有率の高いSn－Pb系はんだ組成物を、400℃以上の高温で使用することが一般的に行われてきた。また近年、環境問題を配慮してPbを含まないSn，Cuを主成分とし、残部がAg，Bi，Sb，In等からなるはんだ組成物、いわゆるPbフリーはんだ組成物が用いられる場合もある。

【発明が解決しようとする課題】しかしながら、従来のSn－Pb系はんだ組成物は、毒性を有するPbを含んでいるため、その使用が制限されつつある。また、従来のいわゆるPbフリーはんだ組成物は、Snが主成分であることから、上述の絶縁樹脂で被覆された金属線の被覆剥離とはんだ付けの両方を同時に行うと、剥き出しになった導体のCu成分がはんだ組成物に溶解する、いわゆる溶食現象が発生し、導体が断線するという問題点がある。本発明の目的は、上述の問題点を解消すべくなされたもので、Cuを主成分とする導体の溶食に関して従来のSn－Pb系はんだ組成物に近い特性を有する、Sn基のいわゆるPbフリーはんだ組成物を提供することを目的とする。

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【課題を解決するための手段】上記目的を達成するために、本発明のはんだ組成物は、Ni0．01重量%以上0．5重量%以下と、Cu2重量%を超えて5重量%以下と、残部Snとからなり、Pbを含有しないことを特徴とする。また、上述のはんだ組成物は、さらにAg，In，Zn，Sb，GeおよびPからなる群より選ばれる少なくとも1種を含有してなることを特徴とする。また、上述のはんだ組成物は、Ag0．01～3．5重量%，Sb0．01～5重量%，Zn0．01～9重量%，In0．01～10重量%，Bi0．01～3重量%，Ge0．01～0．5重量%およびP0．01～0．5重量%からなる群より選ばれる少なくとも1種と、Ni0．01重量%以上0．5重量%以下と、Cu2重量%を超えて5重量%以下と、残部Snとからなることを特徴とする。また、本発明のはんだ付け物品は、Cuを主成分とする導体と、導体に電気的かつ機械的に接合するように取り付けられた本発明のはんだ組成物と、からなることを特徴とする。また、本発明のはんだ付け物品は、磁性体材料を主成分とするセラミック素体と、セラミック素体上に設けられた一対の端子電極と、セラミック素体に巻き付けられたCuを芯材とする導体と、導体の一方端部が端子電極の一方に、電気的かつ機械的に接合するように取り付けられた本発明のはんだ組成物と、からなることを特徴とする。

【発明の実施の形態】本発明のはんだ組成物におけるNi成分の構成割合は、はんだ組成物100重量%のうち0．01重量%以上0．5重量%以下であることを要する。すなわち、Ni成分の構成割合が0．01重量%を下回ると、Cu導体の溶食現象を低減させる本発明の効果が得られない。他方、Ni成分の構成割合が0．5重量%を上回ると、はんだ組成物の液相線温度が上昇し、同じ温度ではんだ付けした場合にブリッジ不良や外観不良が生じ、これを回避するために高い温度ではんだ付けすると、高熱による電子部品の特性不良が生じる恐れがある。本発明のはんだ組成物におけるCu成分の構成割合は、はんだ組成物100重量%のうちCu2重量%を超えて5重量%以下であることを要する。すなわち、Cu成分の構成割合が2重量%以下であると、Cu導体の溶食現象を低減させる本発明の効果が得られない。他方、Cu成分の構成割合が5重量%を上回ると、はんだ組成物の液相線温度が上昇し、同じ温度ではんだ付けし

た場合にブリッジ不良や外観不良が生じ、これを回避するために高い温度ではんだ付けすると、高熱による電子部品の特性不良が生じる恐れがある。本発明のはんだ組成物は、さらにＡｇ，Ｉｎ，Ｚｎ，Ｓｂ，ＧｅおよびＰからなる群より選ばれる少なくとも１種を含有しても構わない。Ａｇ成分やＳｂ成分の含有により、はんだ付き性やはんだの機械的強度が向上する効果が見込まれ、Ｚｎ，Ｉｎ，Ｂｉ成分の含有により、はんだの融点制御が容易になる効果が見込まれ、Ｇｅ成分やＰ成分の含有により、はんだが酸化皮膜を形成することを抑制する効果が見込まれる。上述の元素の具体的な構成割合としては、はんだ組成物１００重量％のうちＡｇであれば０．０１～３．５重量％、Ｓｂであれば０．０１～５重量％、Ｚｎであれば０．０１～９重量％、Ｉｎであれば０．０１～１０重量％、Ｂｉであれば０．０１～３重量％、Ｇｅであれば０．０１～０．５重量％、Ｐであれば０．０１～０．５重量％の範囲内であることが好ましい。Ａｇ成分の構成割合が０．０１重量％を下回ると、Ａｇ成分を含有することによる上述の効果、すなわち半田付き性やはんだの機械的強度が向上するという効果が得られない。他方、Ａｇ成分の構成割合が３．５重量％を上回ると、Ag_3Sn等の金属間化合物が肥大化することにより機械的強度の低下を招く問題や、液相線温度を上昇させる問題から、作業性の低下を招く恐れがある。Ｓｂ成分の構成割合が０．０１重量％を下回ると、Ｓｂ成分を含有することによる上述の効果、すなわち、半田付き性やはんだの機械的強度が向上するという効果が得られない。他方、Ａｇ成分の構成割合が５重量％を上回ると、ＳｎＳｂ等の金属間化合物が肥大化することにより機械的強度の低下を招く問題や、液相線温度を上昇させる問題から、作業性の低下を招く恐れがある。Ｚｎ成分の構成割合が０．０１重量％を下回ると、Ｚｎ成分を含有することによる上述の効果、すなわち、はんだの融点制御が容易になる効果が得られない。他方、Ｚｎ成分の構成割合が５重量％を上回ると、Ｓｎ－Ｚｎ２元低融点共晶（液相線温度１９９℃）が生成することにより、はんだ耐熱性の低下を招く恐れがある。Ｉｎ成分の構成割合が０．０１重量％を下回ると、Ｉｎ成分を含有することによる上述の効果、すなわち、はんだの融点制御が容易になる効果が得られない。他方、Ｉｎ成分の構成割合が１０重量％を上回ると、Ｓｎ－Ｉｎ２元低融点共晶（液相線温度１１７℃）が生成することにより、はんだ耐熱性の低下を招く恐れがある。Ｂｉ成分の構成割合が０．０１重量％を下回ると、Ｂｉ成分を含有することによる上述の効果、すなわち、はんだの融点制御が容易になる効果が得られない。他方、Ｂｉ成分の構成割合が３重量％を上回ると、Ｓｎ－Ｂｉ２元低融点共晶（液相線温度１３９℃）が生成することにより、はんだ耐熱性の低下を招く恐れがある。Ｇｅ成分の構成割合が０．０１重量％を下回ると、Ｇｅ成分を含有することによる上述の効果、すなわち、はんだが酸化皮膜を形成することを抑制する効果が得られない。他方、Ｇｅ成分の構成割合が０．５重量％を上回ると、液相線温度を上昇させる問題から、作業性の低下を招く恐れがある。Ｐ成分の構成割合が０．０１重量％を下回ると、Ｐ成分を含有することによる上述の効果、すなわち、はんだが酸化皮膜を形成することを抑制する効果が得られない。他方、Ｐ成分の構成割合が０．５重量％を上回ると、液相線温度を上昇させる問題から、作業性の低下を招く恐れがある。なお、本発明のはんだ組成物に、上述の成分以外に不可避不純物として、例えばＰｂやＮａ等が混入していることを妨げない。本発明によるはんだ付け物品の一つの実施形態について、図１に基づいて詳細に説明する。はんだ付け物品１は、セラミック素体２と、端子電極３，３と、導体４と、はんだ組成物５，５と、からなる。セラミック素体２は、例えば磁性体として機能する材料を含み、例えば素体の一方主面の中央部近傍に形成部を備えた凹型形状を備えている。端子電極３，３は、例えばセラミック素体２の長さ方向の端部に形成されており、端子電極形成用の導電性ペーストが塗布され焼付けられてなる。導体４は、例えばＣｕを芯材とした金属線からなり、絶縁樹脂により被覆され、セラミック素体２の長さ方向に対して直行する方向に巻き付けられてコイル状をなしている。金属線４の端部４ａ，４ｂは、それぞれ端子電極３，３の一方に接触するように延びており、本発明のはんだ組成物５によって端部４ａ，４ｂを被覆する絶縁樹脂が溶解され、かつ端子電極３，３と端部４ａ，４ｂは電気的かつ機械的に接合されている。

本発明によるはんだ付け物品の他の実施形態について、図２に基づいて詳細に説明する。はんだ付け物品１１は、セラミック素体１２と、端子電極１３，１３と、はんだ組成物１４，１４と、導体１５，１５と、外装樹脂１６とからなる。セラミック素体１２は、セラミックグリーンシートを焼成した円板型の焼結体からなる。端子電極１３，１３は、セラミック素体１２の両主面に形成された一対の電極膜からなる。はんだ組成物１４，１４は、端子電極１３，１３と導体１５，１５をそれぞれ電気的かつ機械的に接合するように端子電極１３，１３上に形成されている。外装樹脂１６は、セラミック素体１２と端子電極１３，１３とはんだ組成物１４，１４を覆うように形成されている。セラミック素体１２は、例えば誘電体，絶縁体，半導体，圧電体，磁性体として機能する材料を含むもの等を適宜用いることができる。なお、図１に示したセラミック素体１２の形状は円板型であるが、セラミック素体１２の形状は特に円板型に限定されることなく、端子電極１３，１３を形成するのに十分な面を備えるのであれば、例えば角板型等を適宜用いることができる。端子電極１３，１３は、セラミック素体１２の両主面に形成された電極膜であり、例えば、無電解Ｎｉメッキにより形成される場合、メッキ浴中の還

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元剤成分の種類によりＮｉＰあるいはＮｉＢ合金等の層として膜形成され、Ａｇを導電成分とする厚膜電極である場合、Ａｇペーストが印刷または塗布され乾燥された後に焼付けられて膜形成される。なお、端子電極の形状ならびに大きさは、本発明の実施形態に限定されることなく、例えば、セラミック素体１２の両主面の全体に形成、あるいは任意の形状のギャップ幅を取って形成することができ、何れの場合においても本発明の効果が得られる。また、端子電極の層数は、本発明の実施形態に限定されることなく、例えば、第１層の端子電極上にさらに第２層の端子電極を形成してもよく、また何層形成されていても構わない。はんだ組成物１４，１４の材質、形状ならびに大きさは、本発明の実施形態に限定されることなく、例えば、端子電極１３，１３の全体に形成、あるいは端子電極１３，１３上の任意の一部分であってもよく、何れの場合であっても構わない。導体１５，１５の材質、形状ならびに大きさは、本発明の実施形態に限定されることなく、例えば、ＣｕまたはＣｕを主成分とする合金等からなる金属線を芯材として、必要に応じて金属線の表面にＳｎ，Ｃｕ，Ｐｄ，Ａｕ，Ｆｅ，Ｓｎ－Ｃｕ，Ｓｎ－Ａｇ，Ｓｎ－Ａｇ－Ｃｕメッキを施した線形状の導体等を適宜用いることができるが、Ｃｕを主成分とする金属線を芯材として、絶縁樹脂によって金属線の表面が被覆された導体の場合、はんだ付け時に絶縁樹脂が溶解され、Ｃｕ芯材が剥き出しとなるためＳｎ基はんだ組成物に溶食されやすいが、本発明のはんだ組成物を用いることによりこの溶食が抑制されるため、本発明の効果が顕著となる。また、端子電極１３，１３に接合される導体１５の数は、本発明の実施形態に限定されることなく、１つの端子電極１３に２本以上の導体１５を接合しても構わない。外装樹脂１６は、例えば、エポキシ樹脂やシリコン樹脂等が挙げられるが、特にこれらに限定されることなく、絶縁性，耐湿性，耐衝撃性，耐熱性等に優れるものであれば代表的な樹脂を適宜用いることができる。なお、外装樹脂１６は必ずしも備えている必要はなく、また何層形成されていても構わない。なお、本発明のはんだ付け物品は、上述の実施形態に限定されることなく、Ｃｕを主成分とする導体と、導体に電気的かつ機械的に接合するように取り付けられた本発明のはんだ組成物と、からなるはんだ付け物品全般に対して向けられる。

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【実施例】まず、表１に示す構成割合からなるはんだ組成物を準備し、それぞれ実施例１～１４ならびに比較例１～７のはんだ組成物とした。次いで、コンデンサとして機能する、８ｍｍφのチタン酸バリウムを主成分とするセラミック素体を準備し、このセラミック素体の両主面全体にＡｇペーストを塗布し乾燥させ焼付けて、端子電極を形成した。次いで、導体として１ｍｍφの９９．９９％軟Ｃｕ金属線を準備し、金属線の端部が上述のセラミック素体の端子電極に接した状態で、それぞれ実施例１～１４ならびに比較例１～７のはんだ組成物中に浸漬してはんだ付けして、それぞれ実施例１～１４ならびに比較例１～７のはんだ組成物を用いた試料を得た。なお、はんだ付け条件は、４００℃，４５０℃，５００℃でそれぞれ行ない、浸漬時間は５ｓｅｃ、導体の浸漬深さは１０ｍｍ、浸漬速度は１０ｍｍ／ｓｅｃとした。また、フラックスには、ロジン２５重量％ＩＰＡ溶液を用いた。そこで、試料１～１４ならびに比較例１～７のはんだ組成物を用いた試料について、４００℃，４５０℃，５００℃ではんだ付けした場合の導体のＣｕの溶食速度、４００℃ではんだ付けした場合のはんだ付き性を測定し、評価を加えた。なお、Ｃｕの溶食速度については、はんだ付け後の導体の断面をエメリー紙で面出しして、バフで鏡面研磨した後、金属顕微鏡で導体の直径を測定し、次式によって求めた。Ｃｕの溶食速度（μｍ／ｓｅｃ）＝（１０００－残留する導体の直径（μｍ））／２／５。また、はんだ付き性については、はんだ付け後の導体の側面部を画像処理によってはんだ付着面積を求め、浸漬面積に対するはんだの付着している面積の比を算出した。また、評価については、本発明の範囲のうち特に優れる試料については「◎」、次に優れる本発明の範囲の試料については「○」、比較例の試料のうちＣｕの溶食速度あるいははんだ付き性が劣るものについては「×」とした。

【表１】

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試料		はんだ合金組成（質量%）											Cu溶食速度（μm/sec）			はんだ付き性（%）	評価
		Sn	Cu	Ni	Ag	In	Bi	Zn	Sb	Ge	P	Pb	400℃	450	500		
実施例	1	97.99	2.50	0.01									0.8	2.2	5.7	100	○
	2	97.85	2.50	0.15									0.7	2.1	5.6	100	○
	3	97.85	2.50	0.30									0.0	1.4	3.9	100	○
	4	97.50	2.50	0.50									0.2	0.1	3.5	100	○
	5	94.99	5.00	0.01									0.0	0.9	3.0	95	○
	6	94.85	5.00	0.15									0.0	0.7	1.8	95	○
	7	94.50	5.00	0.50									0.0	0.0	0.5	92	◎
	8	94.20	2.50	0.30	3.50								0.0	1.3	3.9	100	○
	9	97.70	2.50	0.30		10.00							0.0	1.1	3.8	100	○
	10	94.70	2.50	0.30			3.00						0.0	0.9	3.4	100	○
	11	88.70	2.50	0.30				9.00					0.0	0.6	1.4	90	◎
	12	92.70	2.50	0.30					5.00				0.0	1.0	3.7	100	○
	13	97.20	2.50	0.30						0.50			0.0	1.4	3.8	100	○
	14	97.20	2.50	0.30							0.50		0.0	1.4	3.9	100	○
比較例	1	97.50	2.50										1.0	2.5	6.0	100	×
	2	99.30	0.70										1.5	3.2	6.5	100	×
	3	93.00	7.00										0.0	0.8	3.0	69	×
	4	95.75	0.75		3.50								1.4	3.1	6.3	100	×
	5	96.50			3.50								1.8	4.2	8.3	100	×
	6	95.50	0.50		2.00		2.00						1.6	3.4	6.8	100	×
	7	30.00										70.00	0.0	1.1	2.2	100	—

表1から明らかであるように、ならびにＳｎ９４．５重量％－Ｃｕ５重量％－Ｎｉ０．５重量％からなる実施例７のはんだ組成物を用いた試料、Ｓｎ９４．８５重量％－Ｃｕ５重量％－Ｎｉ０．１５重量％からなる実施例６のはんだ組成物を用いた試料は、はんだ付き性が９２～９５％で十分許容できる範囲内であり、かつ５００℃ではんだ付けした場合のＣｕの溶食速度がそれぞれ１．８７μｍ／ｓｅｃ，０．５７μｍ／ｓｅｃであり、比較例として挙げたＳｎ３０重量％－Ｐｂ７０重量％からなる比較例７のはんだ組成物を用いた試料と比較して、Ｃｕの溶食速度については優れる結果が得られた。また、実施例６および７のはんだ組成物を用いた試料を除いて、Ｎｉ０．０１重量％以上０．５重量％以下と、Ｃｕ２重量％を超えて５重量％以下と、残部Ｓｎとからなり、Ｐｂを含有しない実施例１～５のはんだ組成物を用いた試料も、Ｃｕの溶食速度がＳｎ９７．５重量％－Ｃｕ２．５重量％からなる比較例１のはんだ組成物と比較すると、Ｎｉを含有する効果、すなわち、Ｃｕ導体の溶食現象を低減させる本発明の効果が得られていることが分かる。また、Ｎｉ０．０１重量％以上０．５重量％以下と、Ｃｕ２重量％を超えて５重量％以下と、さらにＡｇ，Ｉｎ，Ｂｉ，Ｚｎ，Ｓｂ，Ｇｅ，Ｐから選ばれる元素と、残部Ｓｎとからなり、Ｐｂを含有しない実施例８～１４のはんだ組成物を用いた試料も、５００℃ではんだ付けした場合におけるＣｕの溶食速度が１．４～３．＊９μｍ／ｓｅｃで、はんだ付き性も９０～１００％であり、何れも比較例１のはんだ組成物と比較して、Ｎｉを含有する効果、すなわち、Ｃｕ導体の溶食現象を低減させる本発明の効果が得られていることが分かる。なお、実施例１１のはんだ組成物を用いた試料は、Ｃｕの溶食速度については、従来例として挙げたＳｎ３０重量％－Ｐｂ７０重量％からなる比較例７のはんだ組成物を用いた試料よりも、優れる結果が得られた。これに対してまた、Ｃｕ成分の含有量が少なくＮｉを含有しないＳｎ９９．３重量％－Ｃｕ０．７重量％からなる比較例２のはんだ組成物を用いた試料は、５００℃ではんだ付けした場合のＣｕの溶食速度も６．０μｍ／ｓｅｃを上回り、高く劣ることが分かる。また、Ｃｕ成分の含有量が多くＮｉを含有しないＳｎ９３重量％－Ｃｕ７重量％からなる比較例３のはんだ組成物を用いた試料は、はんだ付き性が６９％で低く劣ることが分かる。また、Ｎｉ成分を含有せずＡｇ成分を含有するＳｎ９５．７５重量％－Ｃｕ０．７５重量％－Ａｇ３．５重量％からなる比較例４のはんだ組成物を用いた試料は、５００℃ではんだ付けした場合のＣｕの溶食速度が６．３μｍ／ｓｅｃで高く劣ることが分かる。また、Ｃｕ成分およびＮｉ成分を含有せずＡｇ成分を含有するＳｎ９６．５重量％－Ａｇ３．５重量％からなる比較例５はんだ組成物を用いた試料は、５００℃ではんだ付けした場合のＣｕの溶食速度が８．３μｍ／ｓｅｃで高く劣ることが分かる。また、

Ｎｉ成分を含有せずＡｇ成分およびＢｉ成分を含有するＳｎ９５．５重量％－Ｃｕ０．５重量％－Ａｇ２．０重量％－Ｂｉ２．０重量％からなる比較例６はんだ組成物を用いた試料は、５００℃ではんだ付けした場合のＣｕの溶食速度が６．８μｍ／ｓｅｃで高く劣ることが分かる。

【発明の効果】以上のように本発明によれば、Ｎｉ０．０１重量％以上０．５重量％以下と、Ｃｕ２重量％を超えて５重量％以下と、残部Ｓｎとからなり、Ｐｂを含有しないことを特徴とすることで、Ｃｕを主成分とする導体の溶食に関して従来のＳｎ－Ｐｂ系はんだ組成物に近い特性を有する、いわゆるＰｂフリーはんだ組成物が得られる。また、上述のはんだ組成物は、さらにＡｇ，Ｉｎ，Ｚｎ，Ｓｂ，ＧｅおよびＰからなる群より選ばれる少なくとも１種を含有してなることを特徴とすることで、Ｃｕを主成分とする導体の溶食に関して従来のＳｎ－Ｐｂ系はんだ組成物に近い特性を有する同時に、Ａｇ成分やＳｂ成分の含有により、はんだ付き性やはんだの機械的強度が向上する効果が見込まれ、Ｚｎ，Ｉｎ，Ｂｉ成分の含有により、はんだの融点制御が容易になる効果が見込まれ、Ｇｅ成分やＰ成分の含有により、はんだが酸化皮膜を形成することを抑制する効果が見込まれる。本発明のはんだ付け物品は、Ｃｕを主成分とする導体と、導体に電気的かつ機械的に接合するように取り付けられた本発明のはんだ組成物と、からなることを特徴とすることで、Ｃｕを主成分とする導体がはんだ組成物によって溶食されることが抑制され、導体が断線する恐れが低減するという効果が得られる。

【図面の簡単な説明】

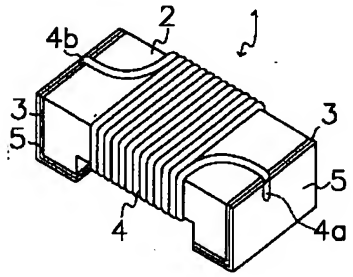
【図１】本発明に係る一つの実施形態のはんだ付け物品の斜視図である。

【図２】本発明に関わる他の実施形態のはんだ付け物品の破断図である。

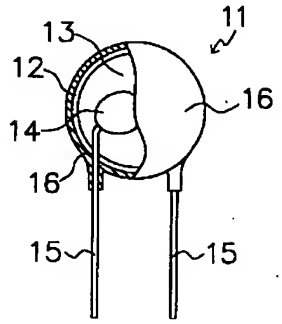
【符号の説明】

1　はんだ付け物品
2　セラミック素体
3　端子電極
4　導体
5　はんだ組成物

【図１】



【図２】



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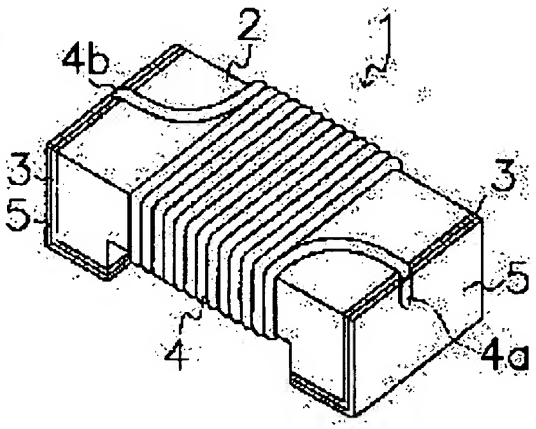
HAMADA KUNIHIKO

(54) SOLDER COMPOSITION AND SOLDERED ARTICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an Sn-based Pb-free solder composition having characteristics close to those of the conventional Sn-Pb solder composition as to the corrosion of a conductor essentially consisting of Cu.

SOLUTION: The solder composition in this invention contains, by weight, 0.01 to 0.5% Ni and >2 to 5% Cu, and the balance Sn and does not contain Pb. The soldered article in this invention is composed of a conductor essentially consisting of Cu and the solder composition in this invention fitted so as to electrically and mechanically be joined to the conductor.



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[Date of extinction of right]	

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] 0.5 or less % of the weight of nickel, the solder constituent which becomes 5 or less % of the weight from Remainder Sn exceeding 2 % of the weight of Cu(s) 0.01% of the weight or more, and is characterized by not containing Pb.
[Claim 2] The solder constituent according to claim 1 characterized by coming to contain at least one sort chosen from the group which furthermore consists of Ag, In, Zn, Sb, germanium, and P.
[Claim 3] At least one sort chosen from the group which consists of 0.01 - 3.5 % of the weight of Ag, 0.01 - 5 % of the weight of Sb(s), 0.01 - 9 % of the weight of Zn, 0.01 - 10 % of the weight of In(s), 0.01 - 3 % of the weight of Bi(s), 0.01 - 0.5 % of the weight of germanium, and P0.01-0.5 % of the weight, and 0.5 or less % of the weight of nickel, the solder constituent by which it be becoming [exceeding 2 % of the weight of Cu(s) / 5 or less % of the weight / from Remainder Sn-0.01% of the weight or more characterized
[Claim 4] the conductor which uses Cu as a principal component, and the solder constituent given in any of claims 1-3 they are attached so that it might join to said conductor electrically and mechanically -- since -- the soldering goods characterized by becoming.
[Claim 5] the terminal electrode of the pair prepared on the ceramic element assembly containing the ingredient which functions as the magnetic substance, and said ceramic element assembly, the conductor which makes a core material Cu twisted around said ceramic element assembly, and the solder constituent given in any of claims 1-3 they are attached so that said conductor might join electrically [an edge / one side of said terminal electrode] on the other hand, and mechanically -- since -- the soldering goods characterized by to become.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention] This invention relates to a suitable solder constituent and soldering goods, when carrying out to coincidence the covering exfoliation and soldering of a metal wire which were covered especially with insulating resin about the solder constituent and soldering goods which do not contain Pb.
[Description of the Prior Art] Since the conductor which forms a winding coil is conventionally covered with insulating resin in production processes, such as a coil component, the covering exfoliation and soldering of a metal wire which were covered with this insulating resin are carried out to coincidence. In this case, generally using a Sn-Pb system solder constituent with the conventional high Pb content at an elevated temperature 400 degrees C or more has been performed. Moreover, Sn and Cu which do not contain Pb in consideration of an environmental problem are used as a principal component, and the solder constituent with which the remainder consists of Ag, Bi, Sb, In, etc., and the so-called Pb free solder constituent may be used in recent years.
[Problem(s) to be Solved by the Invention] However, since the conventional Sn-Pb system solder constituent contains Pb which has toxicity, the use is being restricted. Moreover, when the so-called conventional Pb free solder constituent performs both covering exfoliation of the metal wire covered with above-mentioned insulating resin, and soldering to coincidence from Sn being a principal component, the so-called corrosion phenomenon which Cu component of the conductor which became unreserved dissolves in a solder constituent occurs, and it has the trouble that a conductor is disconnected. The purpose of this invention was made that an above-mentioned trouble should be canceled, and aims at offering the so-called Pb free solder constituent of Sn radical which has a property near the conventional Sn-Pb system solder constituent about the corrosion of the conductor which uses Cu as a principal component.
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the solder constituent of this invention is characterized by 0.5 or less % of the weight of nickel, and becoming 5 or less % of the weight from Remainder Sn exceeding 2 % of the weight of Cu(s) 0.01% of the weight or more, and not containing Pb. Moreover, it is characterized by an above-mentioned solder constituent coming to contain at least one sort chosen from the group which consists of Ag, In, Zn, Sb, germanium, and P further. Moreover, an above-mentioned solder constituent is characterized by at least one sort chosen from the group which consists of 0.01 - 3.5 % of the weight of Ag, 0.01 - 5 % of the weight of Sb(s), 0.01 - 9 % of the weight of Zn, 0.01 - 10 % of the weight of In(s), 0.01 - 3 % of the weight of Bi(s), 0.01 - 0.5 % of the weight of germanium, and P0.01-0.5 % of the weight and 0.5 or less % of the weight of nickel, the thing [5 or less % of the weight / Remainder / Sn] exceeding 2 % of the weight of Cu(s) 0.01% of the weight or more moreover, the solder constituent of this invention attached so that the soldering goods of this invention might be joined to the conductor which uses Cu as a principal component, and a conductor electrically and mechanically -- since -- it is characterized by becoming. moreover, the solder constituent of this invention attached so that a conductor might, on the other hand, join the soldering goods of this invention to the terminal electrode of the pair prepared on the ceramic

element assembly which uses a magnetic-substance ingredient as a principal component, and the ceramic element assembly, and the conductor which makes a core material Cu twisted around the ceramic element assembly electrically [an edge / one side of a terminal electrode], and mechanically -- since -- it is characterized by becoming.

[Embodiment of the Invention] The configuration rate of nickel component in the solder constituent of this invention requires that it is 0.5 or less % of the weight in 100 % of the weight of solder constituents 0.01% of the weight or more. namely, -- if the configuration rate of nickel component is less than 0.01 % of the weight -- Cu -- the effectiveness of this invention of reducing the corrosion phenomenon of a conductor is not acquired. On the other hand, when it solders at temperature high [when the configuration rate of nickel component exceeds 0.5 % of the weight] in order for a poor bridge and a poor appearance to arise when the liquidus-line temperature of a solder constituent rises and it solders at the same temperature, and to avoid this, there is a possibility that the poor property of the electronic parts by high temperature may arise. The configuration rate of Cu component in the solder constituent of this invention requires that it is 5 or less % of the weight exceeding 2 % of the weight of Cu(s) among 100 % of the weight of solder constituents. namely, -- the configuration rate of Cu component is 2 or less % of the weight -- Cu -- the effectiveness of this invention of reducing the corrosion phenomenon of a conductor is not acquired. On the other hand, when it solders at temperature high [when the configuration rate of Cu component exceeds 5 % of the weight] in order for a poor bridge and a poor appearance to arise when the liquidus-line temperature of a solder constituent rises and it solders at the same temperature, and to avoid this, there is a possibility that the poor property of the electronic parts by high temperature may arise. The solder constituent of this invention may contain at least one sort chosen from the group which consists of Ag, In, Zn, Sb, germanium, and P further. The effectiveness that the mechanical strength of a sex with solder or solder improves is expected by content of Ag component or Sb component, the effectiveness that melting point control of solder becomes easy by content of Zn, In, and Bi component is expected, and the effectiveness which controls that solder forms an oxide film by content of germanium component or P component is expected. If it is Ag among 100 % of the weight of solder constituents, it is 0.01 - 3.5 % of the weight, and Sb as a concrete configuration rate of an above-mentioned element, it is 0.01 - 5 % of the weight, and Zn, it is 0.01 - 9 % of the weight, and In, it is 0.01 - 10 % of the weight, and Bi and it is 0.01 - 3 % of the weight, and germanium, if it is P, it is desirable that it is 0.01 - 0.5% of the weight of within the limits 0.01 to 0.5% of the weight If the configuration rate of Ag component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing Ag component, i.e., the effectiveness that the mechanical strength of a sex with solder or solder improves, will not be acquired. On the other hand, when the configuration rate of Ag component exceeds 3.5 % of the weight, and intermetallic compounds, such as Ag3Sn, ****** , there is a possibility of causing the fall of workability, from the problem which causes the fall of a mechanical strength, and the problem which raises liquidus-line temperature. If the configuration rate of Sb component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing Sb component, i.e., the effectiveness that the mechanical strength of a sex with solder or solder improves, will not be acquired. On the other hand, when the configuration rate of Ag component exceeds 5 % of the weight, and intermetallic compounds, such as SnSb, ****** , there is a possibility of causing the fall of workability, from the problem which causes the fall of a mechanical strength, and the problem which raises liquidus-line temperature. If the configuration rate of Zn component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing Zn component, i.e., the effectiveness that melting point control of solder becomes easy, will not be acquired. On the other hand, when the configuration rate of Zn component exceeds 5 % of the weight, and a Sn-Zn [of 2 yuan] low-melt point point eutectic (liquidus-line temperature of 199 degrees C) generates, there is a possibility of causing the fall of solder thermal resistance. If the configuration rate of In component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing In component, i.e., the effectiveness that melting point control of solder becomes easy, will not be acquired. On the other hand, when the configuration rate of In component exceeds 10 % of the weight, and a Sn-In [of 2 yuan] low-melt point point eutectic (liquidus-line temperature of 117 degrees C) generates, there is a possibility of causing the

fall of solder thermal resistance. If the configuration rate of Bi component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing Bi component, i.e., the effectiveness that melting point control of solder becomes easy, will not be acquired. On the other hand, when the configuration rate of Bi component exceeds 3 % of the weight, and a Sn-Bi [of 2 yuan] low-melt point point eutectic (liquidus-line temperature of 139 degrees C) generates, there is a possibility of causing the fall of solder thermal resistance. If the configuration rate of germanium component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing germanium component, i.e., the effectiveness which controls that solder forms an oxide film, will not be acquired. On the other hand, when the configuration rate of germanium component exceeds 0.5 % of the weight, there is a possibility of causing the fall of workability, from the problem which raises liquidus-line temperature. If the configuration rate of P component is less than 0.01 % of the weight, the above-mentioned effectiveness by containing P component, i.e., the effectiveness which controls that solder forms an oxide film, will not be acquired. On the other hand, when the configuration rate of P component exceeds 0.5 % of the weight, there is a possibility of causing the fall of workability, from the problem which raises liquidus-line temperature. In addition, Na etc. is not prevented from Pb or being mixed in the solder constituent of this invention as an unescapable impurity in addition to an above-mentioned component. One operation gestalt of the soldering goods by this invention is explained to a detail based on drawing 1 . the soldering goods 1 -- the ceramic element assembly 2, the terminal electrodes 3 and 3, a conductor 4, and the solder constituents 5 and 5 -- since -- it becomes. The ceramic element assembly 2 is equipped with the concave configuration of an element assembly equipped with the formation section near the center section of the principal plane on the other hand, including the ingredient which functions as the magnetic substance. The terminal electrodes 3 and 3 are formed in the edge of the die-length direction of the ceramic element assembly 2, and the conductive paste for terminal electrode formation is applied, and it comes to bake them. A conductor 4 consists of a metal wire which made Cu the core material, it is covered with insulating resin, is twisted in the direction which goes direct to the die-length direction of the ceramic element assembly 2, and is making the coiled form. The edges 4a and 4b of a metal wire 4 have extended so that one side of the terminal electrodes 3 and 3 may be contacted, respectively, the insulating resin which covers Edges 4a and 4b with the solder constituent 5 of this invention is dissolved, and the terminal electrodes 3 and 3 and Edges 4a and 4b are joined electrically and mechanically.

Other operation gestalten of the soldering goods by this invention are explained to a detail based on drawing 2 . The soldering goods 11 consist of the ceramic element assembly 12, the terminal electrodes 13 and 13, the solder constituents 14 and 14, conductors 15 and 15, and sheathing resin 16. The ceramic element assembly 12 consists of a sintered compact of the disk mold which calcinated the ceramic green sheet. The terminal electrodes 13 and 13 consist of an electrode layer of the pair formed in both the principal planes of the ceramic element assembly 12. The solder constituents 14 and 14 are formed on the terminal electrode 13 and 13 so that conductors 15 and 15 may be joined to the terminal electrodes 13 and 13 respectively electrically and mechanically. Sheathing resin 16 is formed so that the ceramic element assembly 12, the terminal electrodes 13 and 13, and the solder constituents 14 and 14 may be covered. The thing containing the ingredient which functions as a dielectric, an insulator, a semi-conductor, a piezo electric crystal, and the magnetic substance etc. can be suitably used for the ceramic element assembly 12. In addition, although the configuration of the ceramic element assembly 12 shown in drawing 1 is a disk mold, especially the configuration of the ceramic element assembly 12 can use a corner guard mold etc. suitably, for example, if it has sufficient field to form the terminal electrodes 13 and 13, without being limited to a disk mold. When it is the electrode layer formed in both the principal planes of the ceramic element assembly 12, for example, is the thick-film electrode in which film formation is carried out by the class of reducing-agent component under plating bath as layers, such as NiP or a NiB alloy, and which uses Ag as an electric conduction component when formed of non-electrolyzed nickel plating, after being printed or applied and drying Ag paste, film formation of the terminal electrodes 13 and 13 is baked and carried out. In addition, the configuration and magnitude of a terminal electrode can take and form formation or the gap width of face of the configuration of

arbitration in both the whole principal plane of the ceramic element assembly 12, for example, without being limited to the operation gestalt of this invention, and when it is any, the effectiveness of this invention is acquired. Moreover, without being limited to the operation gestalt of this invention, even if the number of layers of a terminal electrode may form the terminal electrode of the 2nd layer further on the terminal electrode of the 1st layer and is formed how many layers, for example, it is not cared about. Without being limited to the operation gestalt of this invention, the quality of the material, the configuration, and magnitude of the solder constituents 14 and 14 may be a part of arbitration on formation of the terminal electrode 13, and 13, and even if they are which case, they do not care about the whole terminal electrodes 13 and 13, for example. The quality of the material, the configuration, and magnitude of conductors 15 and 15 The metal wire which consists of an alloy which uses Cu or Cu as a principal component, for example is made into a core material, without being limited to the operation gestalt of this invention. Although the conductor of the shape of linearity which performed Sn, Cu, Pd, Au, Fe, Sn-Cu, Sn-Ag, and Sn-Ag-Cu plating on the surface of the metal wire if needed etc. can be used suitably When it is the conductor by which the front face of a metal wire was covered by insulating resin by making into a core material the metal wire which uses Cu as a principal component, Since insulating resin is dissolved at the time of soldering and Cu core material serves as nakedness, corrosion is easy to be carried out to Sn radical solder constituent, but since this corrosion is controlled by using the solder constituent of this invention, the effectiveness of this invention becomes remarkable. Moreover, the number of the conductors 15 joined to the terminal electrodes 13 and 13 may join two or more conductors 15 to one terminal electrode 13, without being limited to the operation gestalt of this invention. Although an epoxy resin, silicon resin, etc. are mentioned, if sheathing resin 16 is excellent in insulation, moisture resistance, shock resistance, thermal resistance, etc., typical resin can be suitably used for it, without being limited to especially these. In addition, it is not necessary to necessarily have sheathing resin 16 and, and it may be formed how many layers. in addition, the solder constituent of this invention attached so that the soldering goods of this invention might be joined to the conductor which uses Cu as a principal component, and a conductor electrically and mechanically, without being limited to an above-mentioned operation gestalt -- since -- it is turned to the becoming soldering goods at large. [Example] First, the solder constituent which consists of a configuration rate shown in Table 1 was prepared, and it considered as the solder constituent of examples 1-14 and the examples 1-7 of a comparison, respectively. Subsequently, the ceramic element assembly which functions as a capacitor and which uses the barium titanate of 8mmphi as a principal component was prepared, and both the whole principal plane of this ceramic element assembly was made to apply and dry Ag paste, it baked, and the terminal electrode was formed. Subsequently, the 99.99% ** Cu metal wire of 1mmphi was prepared as a conductor, after the edge of a metal wire had touched the terminal electrode of an above-mentioned ceramic element assembly, in the solder constituent of examples 1-14 and the examples 1-7 of a comparison, it was immersed and soldered, respectively, and the sample using the solder constituent of examples 1-14 and the examples 1-7 of a comparison was obtained, respectively. In addition, soldering conditions were performed at 400 degrees C, 450 degrees C, and 500 degrees C, respectively, and, in immersion time amount, the submergence depth of 5sec(s) and a conductor made 10mm and an immersion rate 10 mm/sec. Moreover, the 25 % of the weight IPA solution of rosin was used for flux. Then, about samples 1-14 and the sample using the solder constituent of the examples 1-7 of a comparison, the sex with solder at the time of soldering at the corrosion rate of Cu of the conductor at the time of soldering at 400 degrees C, 450 degrees C, and 500 degrees C and 400 degrees C was measured, and evaluation was added. In addition, about the corrosion rate of Cu, after carrying out figuring of the cross section of the conductor after soldering with emery paper and carrying out mirror polishing with a buff, the diameter of a conductor was measured with the metaloscope and it asked by the degree type. Corrosion rate (micrometer/sec) =(1000 - diameter of conductor which remains (micrometer))/2/5 of Cu. Moreover, about the sex with solder, the ratio of area to which was asked for soldering arrival area by the image processing, and the solder to immersion area has adhered the lateral portion of the conductor after soldering was computed. Moreover, about what is inferior in the corrosion rate or the sex with solder of Cu among the samples of "O" and the example of a comparison about the

sample of the range of this invention which is excellent in "O" and a degree about the sample which is excellent among the range of this invention about especially evaluation, it considered as "x."

[Table 1]

試料		はんだ合金組成（質量%）											Cu溶食速度（μm／sec）			はんだ付き性（%）	評価
		Sn	Cu	Ni	Ag	In	Bi	Zn	Sb	Ge	P	Pb	400℃	450	500		
実施例	1	97.99	2.50	0.01									0.8	2.2	5.7	100	○
	2	97.85	2.50	0.15									0.7	2.1	5.6	100	○
	3	97.85	2.50	0.30									0.0	1.4	3.9	100	○
	4	97.50	2.50	0.50									0.2	0.1	3.5	100	○
	5	94.99	5.00	0.01									0.0	0.9	3.0	95	○
	6	94.85	5.00	0.15									0.0	0.7	1.8	95	○
	7	94.50	5.00	0.50									0.0	0.0	0.5	92	◎
	8	94.20	2.50	0.30	3.50								0.0	1.3	3.9	100	○
	9	97.70	2.50	0.30		10.00							0.0	1.1	3.8	100	○
	10	94.70	2.50	0.30			3.00						0.0	0.9	3.4	100	○
	11	88.70	2.50	0.30				9.00					0.0	0.6	1.4	90	◎
	12	92.70	2.50	0.30					5.00				0.0	1.0	3.7	100	○
	13	97.20	2.50	0.30						0.50			0.0	1.4	3.8	100	○
	14	97.20	2.50	0.30							0.50		0.0	1.4	3.9	100	○
比較例	1	97.50	2.50										1.0	2.5	6.0	100	×
	2	99.30	0.70										1.5	3.2	6.5	100	×
	3	93.00	7.00										0.0	0.8	3.0	69	×
	4	95.75	0.75		3.50								1.4	3.1	6.3	100	×
	5	96.50			3.50								1.8	4.2	8.3	100	×
	6	95.50	0.50		2.00		2.00						1.6	3.4	6.8	100	×
	7	30.00										70.00	0.0	1.1	2.2	100	—

The sample using the solder constituent of the example 7 which consists of 0.5 % of the weight of 5 % of the weight-nickel of 94.5 % of the weight [of Sn] - Cu(s) so that clearly from Table 1, The sample using the solder constituent of the example 6 which consists of 0.15 % of the weight of 5 % of the weight-nickel of 94.85 % of the weight [of Sn] - Cu(s) It is within the limits which a sex with solder can permit enough at 92 - 95%, and the corrosion rates of Cu at the time of soldering at 500 degrees C are 1.87 micrometer/sec and 0.57 micrometer/sec, respectively. As compared with the sample using the solder constituent of the example 7 of a comparison which consists of 70 % of the weight of 30 % of the weight [of Sn mentioned as an example of a comparison] - Pb(s), the excellent result was obtained about the corrosion rate of Cu. The sample using the solder constituent of examples 6 and 7 is removed. 0.5 or less % of the weight of moreover, 0.01-% of the weight or more nickel, The sample using the solder constituent of the examples 1-5 which become 5 or less % of the weight from Remainder Sn exceeding 2 % of the weight of Cu(s), and do not contain Pb the effectiveness which contains nickel as compared with the solder constituent of the example 1 of a comparison with which the corrosion rate of Cu consists of 2.5 % of the weight of 97.5 % of the weight [of Sn] - Cu(s), i.e., Cu, -- it turns out that the effectiveness of this invention of reducing the corrosion phenomenon of a conductor is acquired. 2 % of the weight of Cu(s) is exceeded with 0.5 or less % of the weight of nickel 0.01% of the weight or more. Moreover, 5 or less % of the weight, The element furthermore chosen from Ag, In, Bi, Zn, Sb, germanium, and P, The corrosion rate of Cu at the time of soldering at 500 degrees C the sample using the solder constituent of the examples 8-14 which consist of the remainder Sn and do not contain Pb by 1.4 - 3.9 micrometer/sec the effectiveness, i.e., Cu, that a sex with solder is also 90 - 100%, and all

contain nickel as compared with the solder constituent of the example 1 of a comparison -- it turns out that the effectiveness of this invention of reducing the corrosion phenomenon of a conductor is acquired. In addition, the result in which the sample using the solder constituent of an example 11 excels the sample using the solder constituent of the example 7 of a comparison which consists of 70 % of the weight of 30 % of the weight [of Sn mentioned as a conventional example] - Pb(s) about the corrosion rate of Cu was obtained. On the other hand, the corrosion rate of Cu at the time of soldering the sample using the solder constituent of the example 2 of a comparison with which the content of Cu component consists of 0.7 % of the weight of 99.3 % of the weight [of Sn which does not contain nickel few] - Cu (s) again at 500 degrees C is also known by that exceed 6.0 micrometer/sec and it is highly inferior. Moreover, it turns out that the sample using the solder constituent of the example 3 of a comparison with which the content of Cu component consists of 7 % of the weight of 93 % of the weight [of Sn which does not contain many nickel] - Cu(s) is low inferior in a sex with solder at 69%. Moreover, it turns out that the corrosion rate of Cu at the time of soldering the sample using the solder constituent of the example 4 of a comparison which consists of 3.5 % of the weight of 0.75 % of the weight-Ag of 95.75 % of the weight [of Sn which does not contain nickel component but contains Ag component] - Cu(s) at 500 degrees C is highly inferior by 6.3 micrometer/sec. Moreover, it turns out that the corrosion rate of Cu at the time of soldering the sample using the example of comparison 5 solder constituent which consists of 3.5 % of the weight of 96.5 % of the weight-Ag of Sn which does not contain Cu component and nickel component, but contains Ag component at 500 degrees C is highly inferior by 8.3 micrometer/sec. Moreover, it turns out that the corrosion rate of Cu at the time of soldering the sample using the example of comparison 6 solder constituent which consists of 2.0 % of the weight of 2.0 % of the weight [of 0.5 % of the weight-Ag of 95.5 % of the weight / of Sn which does not contain nickel component but contains Ag component and Bi component / - Cu(s)] - Bi(s) at 500 degrees C is highly inferior by 6.8 micrometer/sec.

[Effect of the Invention] According to this invention, the so-called Pb free solder constituent which becomes 5 or less % of the weight from Remainder Sn with 0.5 or less % of the weight of nickel exceeding 2 % of the weight of Cu(s) 0.01% of the weight or more, and has a property near the conventional Sn-Pb system solder constituent by it being characterized by not containing Pb about the corrosion of the conductor which uses Cu as a principal component is obtained as mentioned above. Moreover, it is characterized by an above-mentioned solder constituent coming to contain at least one sort chosen from the group which consists of Ag, In, Zn, Sb, germanium, and P further. To the coincidence which has a property near the conventional Sn-Pb system solder constituent about the corrosion of the conductor which uses Cu as a principal component, by content of Ag component or Sb component The effectiveness that the mechanical strength of a sex with solder or solder improves is expected, the effectiveness that melting point control of solder becomes easy by content of Zn, In, and Bi component is expected, and the effectiveness which controls that solder forms an oxide film by content of germanium component or P component is expected. the solder constituent of this invention attached so that the soldering goods of this invention might be joined to the conductor which uses Cu as a principal component, and a conductor electrically and mechanically -- since -- it is characterized by becoming, and it is controlled that corrosion of the conductor which uses Cu as a principal component is carried out with a solder constituent, and the effectiveness that a possibility that a conductor may be disconnected decreases is acquired.

[Translation done.]